ADEQ Arizona Department of Environmental Quality

DRAFT Memorandum

Date: January 19, 2017

To: Facility File

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Groundwater Section

From: Vimal Chauhan, Environmental Engineer
Groundwater Section

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Groundwater Section

Subject: Gunnison Copper Project
Inventory No. 511633; LTF No. 61397
Individual Aquifer Protection Permit (APP) Application

Excelsior Mining Arizona, Inc. (Excelsior) responded to ADEQ's Comprehensive Request for Additional Information (CRAI) dated June 17, 2016. Excelsior's Response to Comments contained two volumes (Volume 1 and Volume 2) were dated September 2016 and received by ADEQ on September 1, 2016. Below are each request for additional information (RAI) in italics followed by ADEQ's review.

Adequate information was provided for the following comments:
1, 3.b, 3.c, 4, 5.a, 5.b, 5.c, 6.a, 6.b, 7.a, 7.b, 10.a, 13.a, 13.b, 13.c, 17.c, 17.d, 18 (part 1), 21, 22, 24, 25.a, 25.b, 25.c, 25.d, 26, 27, 28, 30, 31, 32, 33, 34, 35, 37, 41, 44, Volume III, Appendix M opening comment, 47.a, 47.e, 47.f, 48, 49, 51, 52, and 54.

Additional information from Excelsior is required for the following comments:
2, 3.a, 8.a, 9.a, 11, 12, 14.a, 14.b, 15, 16, 17.a, 17.b, 17.e, 17.f, 18 (part 2), 18.a, 18.b, 20, 23, 29, 36, 38, 39, 40, 42, 43, 45, 46, 47.b, 47.c, 47.d, 47.g, 50, 53, and new comment 55.

CRAI Comment

1. *The application indicates that the bedrock is both fracture dominated and also equivalent porous media (EPM). Excelsior further states that EPM is appropriate for large scale evaluations such as for the groundwater flow model. Excelsior further clarifies that EPM is not appropriate at a scale associated with individual wells and short-term, five day, aquifer tests, and instead the aquifer is fracture dominated. ADEQ agrees with this general characterization. However, you must provide the following information and evaluation, including but not limited to, whether fracture orientation was evaluated based upon oriented*

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core and televiewer-type logs, the data and analysis of fracture density that was evaluated for the geologic model and how the faults and fractures were determined to be either conduits or barriers to groundwater flow per Arizona Administrative Code (A.A.C.) R18-9-A202(A)(5)(b) and A.A.C. R18-9-A202(A)(8)(b)(iii).

ADEQ Evaluation
The response to RAI 1 is adequate.

Excelsior provided a brief description of the amount of core holes that were drilled from 2010 through 2015 (54), how many hydrologic testing and observation (32), and how many drill holes had down-hole geophysics conducted on them. The response provided a brief discussion of on how structural data, geologic data, geophysical data and fracture intensity was used in the creation of the site conceptual model for Gunnison. The response included pictorial examples of core fracture intensities for the Abrigo and Martin Formations. Aquifer testing was used to help assess the fracture characteristics. All of this information, including structural and geologic models used for assessing the copper deposit were utilized in developing the site conceptual model which was used to create the numeric groundwater flow model for the Gunnison deposit. While the response did not directly restate the opinion that the bedrock system in the large scale (for use in the numeric groundwater model) can be modeled as equivalent porous media (EPM) but that assumption is not appropriate in the small scale (i.e., individual well and short-term (3- to 5-day aquifer tests)) the response further clarified Excelsior's statements in the original application and ADEQ agrees with the assessment.

CRAI Comment

2. *The application must discuss how the effectiveness of the injection/recovery wells are to be measured, the adequacy of the planned monitoring well network, outside of the proposed POC wells and if no additional monitoring is proposed why that is adequate per A.A.C. R18-9-A202(A)(5)(b) and A.A.C. R18-9-A202(A)(6).*

ADEQ Evaluation
The response to RAI 2 is **not** adequate.

Excelsior plans to use the North Star Hydrology (NSH) wells as intermediate monitoring wells for the purposes of early detection. There appear to be gaps in NSH well coverage in the eastern portion of the site. Please provide a discussion on why intermediate wells are not needed in the eastern portion of the site per A.A.C. R18-9-A202(A)(5)(b). In addition, please include the mine blocks on the figure or figures to indicate how the NSH wells relate to the various mine blocks, whether they will all be monitored during all phases of mining, if they will not all be continuously monitored, when they will be monitored and provide their screen intervals.

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CRAI Comment

3. *Section 5.4, Groundwater Quality*
In the course of monitoring, Excelsior detected petroleum odors in these and other coreholes, and free product in CS-10 and CS-14. Samples were collected as part of a study of Light Non-Aqueous Phase Liquids (LNAPLs) in groundwater by Haley & Aldrich (2015).

   a. *Please provide additional information regarding the lateral and vertical extent of the petroleum plume in the groundwater per A.A.C. R18-9-A202(A)(8)(b)(vi and vii).*

ADEQ Evaluation
The response to RAI 3a is **not** adequate.

Excelsior indicates that "The extent of petroleum in CS-10 and CS-14 appears to be limited to the immediate area of the boreholes and also indicated that when CS-10 and CS 14 were drilled (1971) it was common to add diesel or any other inexpensive hydrocarbon compounds to the drilling mud to lubricate drill rods. The wells nearest to these borings (NSH-13 and NSH-9, respectively) do not contain LNAPL." In addition, dissolved petroleum compounds have been detected in NSH-15, NS-16 and NSH-17 immediately downgradient of the closed "The Thing" underground storage tank release. The detected petroleum compounds are less than their respective aquifer water quality standards (AWQS).

Excelsior must provide a brief description on whether NSH-13 and NSH-9 are constructed in a similar manner as CS-10 and CS-14.

   b. *Please provide additional information regarding your plan in addressing and determining the source of the petroleum contamination in the groundwater per A.A.C. R18-9-A202(A)(8)(b)(vi and vii).*

ADEQ Evaluation
The response to RAI 3b is adequate.

Excelsior indicates that no additional investigation of the source of petroleum in groundwater will occur due to the source(s) are not ongoing, contamination is pre-existing and the amount of organic compounds are very small and the organics will be removed in the copper recovery process. In general, ADEQ agrees with this assessment.

   c. *Please provide additional information regarding the impact of mixing and injecting petroleum contaminated water to the aquifer per A.A.C. R18-9-A202(A)(8)(b)(vi and vii).*

ADEQ Evaluation
The response to RAI 3c is adequate.

Excelsior adequately described reasonable explanations for the presence of Light Non-

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Aqueous Phase Liquids (LNAPLs) being present in core holes CS-10 and CS-14, primarily by the driller adding diesel or any other inexpensive petroleum products to the drilling mud when these boreholes were drilled, 1971.

Excelsior adequately described how any potential petroleum contaminated water would be treated during the copper recovery process.

CRAI Comment

4. *Section 5.4 (Groundwater Quality)*
Several PAHs were detected in the LNAPL samples from coreholes CS-10 and CS-14 where free product had been recovered.

Per A.A.C. R18-9-A202(A)(8)(b)(vi and vii), please provide information regarding the source of the PAHs in the groundwater. Also, please provide information regarding the lateral and vertical extent of the PAHs plume.

ADEQ Evaluation

The response to RAI 4 is adequate.

Excelsior adequately described reasonable explanations for the presence of Light Non-Aqueous Phase Liquids (LNAPLs) being present in core holes CS-10 and CS-14, primarily due to the driller adding diesel or any other inexpensive petroleum products to the drilling mud when these boreholes were drilled, 1971. ADEQ generally agrees with the explanation based upon the relative limited quantity of petroleum products added during drilling.

CRAI Comment

5. *Section 5.10 (Compliance With AWQS)*
After each block is depleted of copper, Excelsior will rinse the block with groundwater from a nearby source until groundwater within the block meets AWQSs. Geochemical modeling (Appendix J.l) has shown that a rinse-rest-rinse approach will result in groundwater quality that meets AWQSs.

Per A.A.C. R18-9-A202(A)(6)(a and b) and A.A.C. R18-9-A202(A)(8)(b)(vi and vii):

a. *Please provide specific information in describing your term above "a nearby source" especially as petroleum contamination is known to be present in the groundwater within the project.*

b. *Please clarify if the geochemical modeling considered the contaminated water in concluding that rinse-rest-rinse approach will result in groundwater quality that meets AWQSs.*

c. *Please clarify how the geochemical modeling is accurate without knowledge of the lateral/vertical extent and volume of the contamination in the groundwater within the project.*

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ADEQ Evaluation
The responses to RAI 5a, RAI 5b and RAI 5c are adequate.

Excelsior provided analytical results of the potential clean water sources: JCM Section 19 well, Smith Wells 1 and 2, Smith Well #3, the Moore Shaft at JCM and unimpacted groundwater from the hydraulic control wells. Excelsior also provided a discussion of the potential use of petroleum contaminated water and how it would impact rinse-rest-rinse approach of the mine blocks to return groundwater quality of the aquifer to meets the AWQS. The response also provided a discussion on how the geochemical model was used to evaluate the effectiveness of removing PLS from groundwater after mining.

CRAI Comment

6. *Section 5.4.5 (Groundwater Quality in the Vicinity of the Project)*
Several AWQSs were exceeded for each JCM POC well, and the sulfate concentrations were elevated to above gypsum solubility, suggesting the water quality of the JCM POC wells is not representative of the regional groundwater quality. Therefore the JCM POC well water quality data were not included in this APP application.

Per A.A.C. R18-9-A202(A)(6)(a and b) and A.A.C. R18-9-A202(A)(8)(b)(vi and vii):

   a. *Please clarify and discuss the impact of mixing and injecting petroleum contaminated water within the project site and circulating this water to the JCM site.*

   b. *If the petroleum contaminated water from the project site is utilized in the mining process at the JCM site, please provide supporting data and information that the JCM POC well water quality data are not required to monitor the water quality at the JCM POC.*

ADEQ Evaluation
The responses to RAI 6a and RAI 6b are adequate.

Gunnison solutions shall be segregated from all JCM mining solutions at the JCM site and stated any petroleum hydrocarbons present in water from Gunnison will be removed in the SX-EX process. The ponds and facilities at the JCM site that will be used for Gunnison solutions are double-lined and will not impact groundwater at the JCM site.

CRAI Comment

7. *Section 5.101.3 (Pollutant Management Area)*
The PMA is defined in AAC R18-9-A302(2)(a) as "the horizontal plane of the area on which pollutants are or will be placed." A single PMA, approximately 405 acres in size, circumscribes the ISR wellfield and the process solution and non-stormwater ponds (Figure 5-16).

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Per A.R.S. §49-244:

a. *Please clarify why the south and southeastern PMA boundaries are not coinciding with the south and eastern boundaries of the southwest Evaporation Pond.*

b. *Please clarify why there is a sharp angle PMA boundary shape southeast of the Raffinate pond.*

ADEQ Evaluation
The responses to RAI 7a and RAI 7b is adequate.

Excelsior describes how the PMA boundary was determined and why the shape of the PMA boundary southeast of the Raffinate Pond occurs at a sharp angle.

CRAI Comment

8. *Section 5.8 (Groundwater Flow Model)*
Groundwater flow and particle-track modeling (Appendix I) has shown that migration of mining solutions outside the wellfield can be prevented using this approach.

Per A.A.C. R18-9-A202(A)(5)(b):

a. *Please clarify how the groundwater flow and particle-track modeling has accounted for all the injection and recovery wells in all 3 phases of the project without having accurate design and layout of these injection and recovery wells.*

ADEQ Evaluation
The response to RAI 8a is **not** adequate.

Excelsior explains that each model grid represents a 5-spot injection/recovery well pattern since the model grid in the ore body is 75 x 75 feet in size and is 300 x 300 feet in size outside the ore body. ADEQ understands the limitations on how the groundwater flow model works.

ADEQ has the following additional requests to help clarify the sequence of mining and to help clarify closure costs for each phase of mining.

i. Figure 8-1 Updated Mining Block Sequence provides a color scheme for each mine block over 17 years. Some of the colors are very close to each other and are difficult to differentiate. ADEQ requests that the colors be better differentiated between the mine blocks so the sequence is clearer by having different types of hatching and/or other distinguishing mark added to the colors to help clarify mining sequence.

ii. Figure 8-2 Particle Starting Location for Mining Year 5 includes years 2 through 5 but does not include year 1. Please provide a rationale as to why year 1 was not included in

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the particle tracking. In addition, ADEQ requests that particles for year 5 be allowed to run with only year 5 pumping and year 5 hydraulic control wells. Additionally, ADEQ requests additional model runs for year 10 (years 6 to 10), particles added for those mine blocks added during those years and all hydraulic control wells that will be installed and operating at year 10 so closure costs may be determined if there was a cessation of mining during or after Stage I is complete. In addition, to determine closure costs, please see ADEQ evaluation to RAI 14.b on additional analytes added to the intermediate wells. ADEQ requests similar individual evaluations for Stage II and Stage III.

CRAI Comment

9. *Section 5.9 (Process Description and Layout Discharge Impact Area)*
The (DIA) indicated by the MODPATH output is shown on Figures 63 and 64 in Appendix I. It is based on the distance traveled by the particles during the 23-year simulation.

   a. *Please revise Figure 64 to show the PMA boundaries in addition to the existing DIA boundaries per A.A.C. R18-9-A202(A)(8)(b)(xii).*

ADEQ Evaluation

The response to RAI 9a is **not** adequate.

Figure 9-1 Revised Discharge Impact Area 23 Year Simulation shows a discharge impact areas (DIA) that are not the same as the footprint of the lined impoundments. Please provide a discussion on why the DIA for the lined facilities are showing that there will be releases from those facilities per A.A.C. R18-9-A202(A)(5) and A.A.C. R18-9-A202(A)(8)(b)(xiii).

CRAI Comment

10. *Section 1.2.4*
Aquifer testing will be performed at installation, and used to determine layout, pumping or injection rates, and number of injection or recovery wells in a given area.

Per A.A.C. R18-9-A202(A)(8)(b)(iii):

   a. *Please clarify the statement above, what is meant by installation, and how these installations are determined.*

ADEQ Evaluation

The response to RAI 10a is adequate.

The response discussed how long aquifer tests would be conducted to determine the proper spacing for the additional injection/recovery wells. In some locations, it may be necessary to have 7-spot injection/recovery wells instead of the normal 5-spot. Based on what is known of the geology of the ore body, a perfect, uniform 5-spot pattern would be an anomaly, not the normal.

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11. As discussed in Section 1.2.1, production is anticipated to increase in stages.

Please clarify how the groundwater removal rates increase from one stage to another (both hydraulic control and recovery wells), how would it impact the aquifer per A.A.C. R18-9-A202(A)(8)(b)(iii and iv).

ADEQ Evaluation
The response to RAI 11 is **not** adequate.

Excelsior provided tables of net withdrawal rates, estimated average total pumping rate and estimated maximum pumping rate for the three stages of mining and post production rinsing. ADEQ requests an additional table that indicates the estimated amount and rate of water injected and recovered from the mine blocks and the estimated amount and rate of water pumped from the hydraulic control wells.

CRAI Comment
12. Section 1.2.5 (Process Flows)
Clean water that is needed in excess of the groundwater supplied by the hydraulic control wells will be supplied by water supply wells, the location(s) of which are to be determined.

Please identify the source and quality of the clean water that is needed in excess of the groundwater recovered from the injection/recovery well networks per A.A.C. R18-9-A202(A)(8)(b)(iv).

ADEQ Evaluation
The response to RAI 12 is **not** adequate.

Sources of clean water include five potential sources: Johnson Camp Mine (JCM) Section 19 well (55-611610); Smith Well 1 and 2 (55-909280 and 55-911489); Smith Well #3 (55-911560); the Moore Shaft at JCM; and unimpacted water from hydraulic control wells. ADEQ requests that each potential source of clean water be represented on a figure containing each mine block. The volume of clean water that may be used from each source should also be provided with a discussion on whether the groundwater flow model included an evaluation of how this pumping may impact capture.

CRAI Comment
13. Section 1.2.5 (Process Flows)
Sources of water to the Clean Water Pond will include hydraulic control water (Stream 11) and groundwater from water supply wells (Stream 12). In Stages 2 and 3, clean water will be augmented by treated water from the WTP (Stream 18). Clean water will be injected (Stream 13) into the formation and recovered (Stream 14) to reduce concentrations of regulated constituents.

Per A.A.C. R18-9-A202(A)(4):

a. Please clarify the statement above in terms of providing specific information regarding the various chemicals and the utilized procedure in mixing the different waters including treated water from the WTP.

ADEQ Evaluation
The response to RAI 13a is adequate.

The response briefly discussed the water supply during Stage 1 and Stages 2 and 3, how it will be used and stored.

b. Also, please clarify the plan or process that will be utilized in order to ensure that the concentrations of regulated constituents will be reduced.

ADEQ Evaluation
The response to RAI 13b is adequate.

The response provides a brief discussion on how the clean water will be used to rinse and dilute solutions that are present at the end of the leaching cycle. It also describes options on how the impacted rinse water will be taken care of when extracted from the aquifer.

c. Please provide the calculations utilized for mixing the different types of water.

ADEQ Evaluation
The response to RAI 13c is adequate.

Based upon the analytical results of the potential sources of clean water indicating that all of the sources meet AWQSs, the response indicates there will be no impact and therefore did not provide calculations.

CRAI Comment
14. Section 1.2.5 (Process Flows)
The groundwater produced from hydraulic control pumping will be conveyed to the Clean Water Pond.

Per A.A.C. R18-9-A202(A)(8)(b)(iv and vi):

a. Please identify the locations of the hydraulic control wells that will be providing clean water to the Clean Water Pond.

ADEQ Evaluation
The response to RAI 14a is **not** adequate.

The response indicated that the location of the hydraulic control wells was provided in Figure 2-1. This figure did not provide the locations of the hydraulic control wells, only the

intermediate NSH monitoring wells. Please clarify the location of the hydraulic control wells and provide the approximate latitude and longitude for each hydraulic control well.

b. *Please provide the quality of the groundwater that will be pumped from the hydraulic control wells.*

ADEQ Evaluation
The response to RAI 14b is **not** adequate.

Excelsior indicated that initial pumping of groundwater from the hydraulic control wells is expected to be consistent with the groundwater quality in the NSH wells, ADEQ agrees monitoring total dissolved solids (TDS) indirectly through specific conductivity monitoring in the field is an effective way to evaluate whether hydraulic control water has been impacted by "PLS".

Excelsior proposes a permit condition to monitor specific conductivity of groundwater from active hydraulic control wells on a daily basis.

Excelsior proposes a compliance schedule item to conduct ambient groundwater monitoring to identify "operational trigger levels" for specific conductivity. This is not sufficient. A larger suite of analysis, including water level elevation, depth to groundwater, pH, bicarbonate, calcium, carbonate, chloride, fluoride, magnesium nitrate as nitrogen, potassium, sodium, sulfate, TDS, cation/anion balance, dissolved metals (including copper and iron), Gross Alpha, Adjusted Gross Alpha, Radium 226 + 228, Uranium (Total), TPH – diesel and BTEX shall be sampled and analyzed semi-annually. Depth to Groundwater, water level elevation, pH, fluoride, magnesium, sulfate and TDS shall be sampled and analyzed quarterly. This sampling shall occur in the NSH intermediate wells, the observation wells and POC wells. Ambient alert levels (ALs) shall be set in the NSH and observation wells with the POC wells being set to aquifer quality limits (AQLs) and ALs. The ambient groundwater quality shall be set prior to mining. This data shall be used as the baseline for closure per A.A.C. R18-9-A209(B).

CRAI Comment

15. *The WTP will be designed to produce high density solids during the neutralization of treated water. Addition of lime raises the pH causing the precipitation of metal hydroxides and sulfate minerals. The solids will settle in a clarifier to maximize water recovery and solids density. Clarifier underflow, consisting of precipitates, will be routed to a Solids Impoundment (Stream 20).*

Please provide additional information on the process that will be used in handling the Clarifier underflow, consisting of precipitates per A.A.C. R18-9-A202(A)(5).

ADEQ Evaluation
The response to RAI 15 is **not** adequate.

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Excelsior states the solids generated by the water treatment facility (WTF) will be located in a Solids Containment Impoundment which will be double lined facility with leak detection per BADCT. The response does not state what will happen to the brine generated by the reverse osmosis of the solution that is filtered and treated from the WTF. Please state the location of the brine storage per A.A.C. R18-9-A202(A)(3).

CRAI Comment

Volume I

16. *A.R.S. 49-243(B)(1) indicates the facility should be "designed, constructed and operated as to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control technology (BADCT), technology, processes, operating methods or other alternatives, including, where practicable, a technology permitting no discharge of pollutants."*

Per A.A.C. R18-9-A202(A)(5)(a)(i) and (b), please provide an alternative BADCT analysis using the process specified in the Arizona Mining BADCT Guidance Manual (BADCT Manual) in Section 1.1.3, Individual BADCT Review Process For New Facilities. As one of the alternatives, evaluate the BADCT discharge control for in-situ leach with deep well injection as per Section 3.4.5.3.1 of the BADCT Manual which indicates that the recovery wells should be pumped at a greater rate than the injection rate. Please note that the volume of fluids recovered should not include the volume of fluids pumped from the hydraulic control wells (i.e. the cone of depression is maintained at the perimeter of the 5-spot groups within the ore body). Note that the BADCT Manual makes no mention of the use of peripheral hydraulic control wells to achieve the recovery rate and establish the cone of depression to contain, capture and recycle solutions. The alternative BADCT analysis must include an evaluation of the discharge reduction achieved for each alternative with the goal of minimizing discharge to the greatest degree practicable as required by A.R.S. 49-243.B.1.

ADEQ Evaluation

The response to RAI 16 is **not** adequate.

Excelsior provided three alternatives discussed below, and proposed to use Alternative 1.

- Alternative 1, referred to as the Reference Alternative, is the same as that provided in the original application.
- Alternative 2 evaluates pumping of recovery wells within the mining blocks at a greater rate than the injection rate in order to maintain a cone of depression (as required by BADCT manual).
- Alternative 3 involves pumping and injection at approximately equal amounts and pumping from hydraulic control wells near the perimeters of the active blocks within the wellfield.

Alternative 1

The response indicated that Alternative 1 presented in Section 7.1 of the original APP application, was generally unchanged. However, they specifically stated that some of the ore body occurs within the unsaturated zone and in order to leach those areas above the water table, the "leaching solution must be mounded". Average injection rates were provided for each Stage (not per well) in Section 7.1.4.2.2. Excelsior proposed a maximum injection pressure (Section 7.1.4.2.3) of 0.75 psi/ft (measured daily) to prevent hydraulic fracturing and propagation of existing fractures.

Section 7.1.7 Feasibility and Practicability is also new. A few of design advantages listed in this revised section are provided below.

- They propose to minimize drawdown within the wellfield to maximize ore extraction below the water table. They propose to have equal injection/recovery within the mining blocks while providing hydraulic control around the perimeter to the south and east.
- They propose to create a mound within a block (or do they intend to raise the water table within the wellfield?) to extract the unsaturated ore above the water table.
- Excelsior expresses concern about extraction of hydraulic control water for Alternatives 2 and 3 as quoted below:
    - "Alternate pumping schemes that extract hydraulic control water from within or directly adjacent to the active mining area will produce PLS or PLS-impacted waters that cannot be used for rinsing or makeup water. This water will require additional treatment and disposal, thus increasing the area of land that must be disturbed to construct additional evaporation and solids containment pond."
- Excelsior indicated as one of the advantages of Alternative 1 as being "Operationally feasible. It will not be necessary to re-pipe hydraulic control wells to change them to injection/recovery wells (as in the case of Alternative 3). This reduces the chances for accidental releases by digging up an active wellfield."

Alternative 2

Alternative 2 varies from Alternative 1 only in operational controls – specifically hydraulic gradients of discharge. There will be no dedicated hydraulic control wells. All other aspects are pretty much the same as that for Alternative 1. A significant drawback to this alternative is that it will result in partial dewatering of the ore body and thus a loss of access to a portion of the mineral resource. Another disadvantage cited was that there would be a need for additional treatment and disposal capacity (see Alternative 1 advantages above and table presented in Section 7.4.4 on page 7-21).

Excelsior expressed concern over partial dewatering of the ore body and thereby loss of

access to a portion of the ore body. "To simulate net extraction from the wellfield, the overall injection rate was multiplied by 0.03 to account for 3% excess pumping. This rate was spread across all of the active model cells (for each Mining Block). The individual blocks were assigned a rate of 0.03*Total Injection Rate/Number of Active Wells per stress period, thus simulating the pumping as broadly spread over the active mining area."

The simulation drawdown were estimated to be 23 feet after 5 years, 39 feet after 10 years, 99 feet after 13 years, and 91 feet after 16 years.

Excelsior indicated the following on page 7-18:

"To evaluate hydraulic containment for this alternative BADCT, particles were placed around each of the mining blocks, in the next model cell outward from the simulated 3% net-pumping in each block. This simulation was conducted because even with recovery rates that are 3% greater than injection rates, preferred flow pathways could allow particles to escape the active mine block."

Alternative 3

In this alternative, recovery volumes from around each mine block will exceed injection volumes, creating a broad cone of depression in the wellfield. "However, due to concerns with operational feasibility, this approach was not evaluated with the groundwater model".

Excelsior discussed logistical challenges of this alternative due to introduction of operation complexities and increased possibility of accidental releases, and difficulties in relation to installing, connecting, and abandoning recovery wells used for hydraulic control around each mining block (see Section 7.3.2, page 7-19).

While ADEQ accepts with the proposed Alternative 1, ADEQ requests the following additional information.

ADEQ has the following comments on Alternative 1.

a) In Section 7.1.4.2.1 Hydraulic Gradients, it is proposed to use paired observation wells located outside the hydraulic control wells. ADEQ requests that additional wells be considered to document hydraulic control, i.e., NSH wells, along with groundwater contour (potentiometric) maps to help demonstrate capture has been established. Data collected can be used to refine the numeric groundwater flow model.
b) Section 7.1.4.2.2 Injection Flow includes the estimated average injection rate in gallons per minute (gpm) and estimated maximum injection rate in gpm for Stages1, 2, and 3 along with post production rinsing. Excelsior shall provide estimated average and maximum flow rate for each mine block as well as estimated total flow rates.

c) In the second paragraph of Section 7.1.4.3 Borehole Abandonment it is indicated that Excelsior may abandon some wells and core holes to control flow to the shallow bedrock of "PLS". Excelsior must provide a description with the criteria as to when a well and/or core hole would be abandoned to prevent migration.
d) In the sixth paragraph of Section 7.1.5.1 Rinsing Strategy, it is indicated that only 10% of wells within the mining block during the rinsing process will have groundwater monitoring to evaluate effectiveness of rinsing. The list of analytes includes: dissolved metals, sulfate, TDS, pH, VOCs and specific conductivity. Excelsior must provide rationale on how many samples will be collected, including which wells would be sampled. ADEQ recommends a much higher percentage of wells to be sampled. Excelsior must discuss how many wells for each mine year closure are to be sampled.
e) In Section 7.1.6 Post-Closure Groundwater Monitoring, it is proposed to monitor the POC wells for an additional five years annually after rinsing is complete. Excelsior must provide a rationale as to why five years of post-closure monitoring at the POC wells was chosen.

   Excelsior must define when they consider post-closure monitoring begins. ADEQ recommends that post-closure monitoring to monitor for rebound truly begins once rinsing is complete. Excelsior must also indicate the time frame for post-closure monitoring within the rinsed mine blocks and state why that timeframe was chosen.
f) Section 7.1.7 Feasibility and Practicability did not include any disadvantages. Excelsior must provide a description on why there are no disadvantages to their chosen alternative.

ADEQ has the following comments on Alternative 3.

a) In Section 7.2.2 Operational Feasibility, it is indicated that the hydraulic control wells located near the active mine blocks would need to be abandoned as mining advances. This is not necessarily true. The nearby hydraulic control wells could be placed in locations that would allow the hydraulic control wells to be repurposed as injection/recovery wells for a mine block. Additionally, these hydraulic control wells would provide valuable hydrogeologic information to help with the configuration of future mine blocks. This discussion should be included in the evaluation.

b) Section 7.4.4 Summary Table provides an evaluation of the following parameters: Degree of Aquifer Loading; Practicable and Economically Achievable; Demonstrable; Water Resource Conservation; Technical Advantages; and Technical Disadvantages. Under Degree of Aquifer Loading, the response states the reference BADCT alternative, Alternative 1, provides the lowest loading, due to all solutions being contained due to the hydraulic control wells. This is not entirely accurate. Alternative 1 provides the most dilution of any escapes from

the mine blocks, not limiting loading. Excelsior must remember that the bedrock is a drinking water aquifer under A.R.S. § 49-202 and is the sole source of drinking water in the area. So any escape from the mine block should be considered aquifer loading and be evaluated as such. Based upon the comments provided above for Alternative 1 and Alternative 3, the summary table should be revised.

CRAI Comment

17. *A.A.C. R18-9-A202(A)(5)(a) – Section 7.1.4.2.2 indicates that injection rates will depend on several factors including the rate at which recovery wells can be pumped. Also, this section indicates "Compliance with a specific net volume or net rate of extraction in excess of injection is not proposed as a permit condition". ADEQ disagrees, and believes that the permit should include alert levels and requirements to assure the extraction rate exceeds the injection rate so that hydraulic control and the cone of depression barrier are maintained.*

Provide permit conditions and alert levels to demonstrate maintenance of the cone of depression including the following:

a. *What are the criteria for selecting pumping or injection rates, and number of injection or recovery wells in a given area?*

ADEQ Evaluation

The response to RAI 17a is **not** adequate.

Excelsior proposes to maintain approximately balanced injection and recovery rates within the mining block to prevent significant drawdown. A proposed permit condition is that the 30-day rolling average of total volume of injected fluids will not exceed the 30-day rolling average of total volume of recovered fluids (production plus hydraulic control pumping).

Additionally, if the 30-day rolling average of total volume of injected fluids will not exceed the 30-day rolling average of production plus hydraulic control pumping, the contingency plan would be implemented. Based upon the BADCT discussion above, Excelsior should include the following potential ALs for flow: total injection in the mine block(s), total recovery in the mine block(s) and total extraction at the hydraulic control wells.

The section also includes establishing a demonstrable gradient at the well field boundary establishing BADCT. Excelsior also indicates that if an outward hydraulic gradient is measured for one week or more, an inward gradient would be re-established. Excelsior must describe why one week of not having demonstrated capture is an appropriate time to allow the system to continue operating.

Excelsior proposes to establish AL for each observation well pair to maintain an inward gradient, and if an outward hydraulic gradient is measured continuously for more than one week, the inward gradient will be re-established by one or more measures discussed below.

- An increase in pumping rate at one or more hydraulic control wells.

- Installation and operation of one or more additional hydraulic control wells.
- Adjustment of the in-situ wellfield operations.

b. Proposed alert levels for injection and recovery rates.

ADEQ Evaluation
The response to RAI 17b is **not** adequate.

As stated above in ADEQ Evaluation for RAI 17a, Excelsior must provide a rationale as to why ALs should not be included in the permit.

Excelsior proposes to establish AL for each observation well pair to maintain an inward gradient, and if an outward hydraulic gradient is measured continuously for more than one week, the inward gradient will be re-established by one or more measures discussed in the application.

c. Proposed net differential (e.g. percentage difference) that achieves greater extraction than injection.

ADEQ Evaluation
The response to RAI 17c is adequate.

ADEQ understands the rationale for minimizing drawdown in mining blocks to be able to mine the copper resource. Hydraulic control at the perimeter is expressed as the primary component of BADCT. Excelsior states that as long as the inward hydraulic gradient is maintained at the line of hydraulic control, the actual pumping and injection rates and the difference between them is irrelevant. However, Excelsior does propose to record daily the inflow/outflow measurements of total injection, production, and hydraulic control volumes with an alert level of the 30-day rolling average of total volume of injected fluids will not exceed the 30-day rolling average of total volume of recovered fluids. Please see ADEQ Evaluation for RAI 17.a.

d. Maximum injection pressure.

ADEQ Evaluation
The response to RAI 17d is adequate.

Maximum injection proposed is 0.75 psi/ft.

e. An alert level for the inward hydraulic gradient. The alert level should be a differential between the water level observed in the intermediate monitoring wells (higher) as compared to the recovery wells (lower).

ADEQ Evaluation

The response to RAI 17e is **not** adequate.

As stated in ADEQ Evaluation for RAI 16, Alternative 1, subpart a, ADEQ requests that additional lines of evidence be utilized to demonstrate capture including groundwater contour maps showing capture at the POC wells and to establish what is going on within the mine block.

Excelsior provided the same discussion as above to Part a. regarding loosing hydraulic control for a week. Please see ADEQ Evaluation for RAI 17.a, pertaining to hydraulic control loss.

f. Propose monitoring of the cone of depression and how it will be verified through direct measurement at the PMA boundary.

ADEQ Evaluation
The response to RAI 17f is **not** adequate.

As stated above in ADEQ Evaluation for RAI 17e, ADEQ requests additional lines of evidence ensuring capture is demonstrated.

"The cone of depression created by the hydraulic control wells will be monitored by measuring water levels with transducers at a frequency of once-per-day (or greater) at the observation well pairs. The observation well pairs on the east side of the wellfield are located inside the PMA but outside the wellfield boundary. Groundwater quality will be monitored at the PMA boundary in the proposed POC wells."

CRAI Comment

18. The application does not include a map clearly identifying the location of the various wells at each stage of the project. Also, Section 7.1.4.2.1 indicates the strategy for controlling solutions is to install hydraulic control wells that will generate overlapping cones of depression around the perimeter of the wellfield. Assumptions in the model include "over the duration of the Project, the total rate of pumping from the ISR wells and hydraulic control wells will be adjusted and maintained to exceed the total rate of lixiviant injection".

This section also states that the location of hydraulic control wells are approximate and the locations will be determined by site-specific conditions and the progression of in-situ mining activities. Also, Section 9.4.2.1 indicates hydraulic control will be monitored by measuring fluid levels in observation well pairs installed in bed rock. ADEQ cannot issue a permit based on a conceptual plan of maintaining hydraulic control.

ADEQ Evaluation
The response to RAI 18 (part 1) is adequate.

Planned locations of hydraulic control wells were presented on Figure 18-1. These locations

are the same as those previously presented. With regards to their locations, Excelsior indicates it is prudent to allow for some flexibility in the locations based on site conditions such as topography, access, or other physical obstacles. Excelsior stated that their plan to maintain hydraulic control is not conceptual.

Per A.A.C. R18-9-A202(A)(1), (2), and (4), please, provide a site plan and a topographic map showing boundaries for each stage (Stages 1, 2, and 3) of the project. Indicate the location of the injection, recovery, intermediate monitoring, observation, hydraulic control, and point of compliance (POC) wells, and the pollutant management area (PMA) for each stage of the 5-spot well pattern on the requested map. The anticipated location and numbers of wells that will be installed during Stage 1 will be required, since a number of factors including but not limited to the PMA and DIA boundaries, and closure costs associated with Stage 1 are dependent on this information. Please note that the as-built location of the injection, recovery, intermediate monitoring, observation, and hydraulic control wells will be required prior to initiation of injection as an amendment to the permit.

ADEQ Evaluation
The response to RAI 18 (part 2) is **not** adequate.

The response included center points for each mine block in Figure 18-2. In addition, Excelsior provided a table, Table 18-1, that indicates how many injection/recovery, existing monitoring, hydraulic control, POC and observation wells. Based upon the table, it is indicated that 2 Observation wells will be installed in year 1 with three hydraulic control wells. However Excelsior's response to RAI 16 Alternative 1 (page 7-6 of revised BADCT demonstration), indicated that two observation wells would be placed at each hydraulic control well. Based upon the table, there seems to be a contradiction, please clarify.

Figure 18-2 showing Stages 1, 2, and 3 with well locations (injection/recovery) color coded by year was provided. Figure 18-3 contains locations of POC wells, hydraulic gradient monitoring wells, and hydraulic control wells. Table 18-1 containing well installations by year was also provided. Based on information presented in Table 18-1 and 18-2, 200 injection/recovery wells are proposed to be installed in Stage 1 by Year 10.

Excelsior indicated that they can provide as-built locations for all wells, but it is not appropriate to address it through an amendment due to significant costs and delays. Excelsior instead proposes to address this requirement through a compliance schedule item.

a. *The applicant must provide approximate center position locations for each injection/recovery well cluster per A.A.C. R18-9-A202(A)(2).*

ADEQ Evaluation
The response to RAI 18a is **not** adequate.

Excelsior referred to Figure 18-2 and Table 18-2 which provides a list of all wells including

northing and easting. However, ADEQ requests that the center point for each mine block be referenced in latitude and longitude.

b. *Provide the rationale for the location of the PMA in relation to the wells, to demonstrate that the PMA is drawn at the limit of the area where pollutants will be placed, including the barrier designed to contain pollutants in the facility pursuant to A.R.S. 49-244.1. Please note that the PMA should be drawn at a location where the cone of depression will be monitored as a permit condition and hydraulic control must be demonstrated on a continuous basis.*

ADEQ Evaluation
The response to RAI 18b is **not** adequate.

To the first part of the comment, Excelsior indicated that the hydraulic control well network creates a cone of depression which forms the barrier. Figures 60, 61, and 62 in Appendix I of the APP Application define the areas of capture.

To the second part of the comment, Excelsior indicated that hydraulic control will be demonstrated on a continuous bases at the observation wells; however, the PMA is located at the break in hydraulic gradient (i.e. the edge of the hydraulic barrier). Excelsior must indicate that hydraulic control will be demonstrated at the POC wells.

CRAI Comment
19. *Per A.A.C. R18-9-A202(A)(4)(a), please indicate the pH and composition (concentration of acid) of the lixiviant.*

ADEQ Evaluation
The response to RAI 19 is adequate.

Excelsior referred to Appendix J.1 of the APP application (Table J-1.1). This table presents the TDS of sulfuric acid at 965,000 milligrams per kilogram (mg/kg). The TDS forecast of the Barren Leach Solution and the forecast composition of the PLS are each 100,000 milligrams per liter (mg/l). The forecast of the groundwater after block rinsing is 3,000 mg/l.

CRAI Comment
20. *A.A.C. R18-9-A202(A)(5)(a) – During Stage I, process solutions will be stored and managed at the Johnson Camp Mine (JCM) facility. Please provide a water balance that includes the volume of fluids that will be sent to the JCM facility from the project site to demonstrate that the ponds at JCM are adequately sized. Please provide a contingency plan to manage solutions at the Project Site, in the event the ponds at the JCM facility are unable to store additional fluids, or should the pipeline to JCM become inoperative. An estimate of volumes maintained in the pipeline to JCM should be provided.*

ADEQ Evaluation
The response to RAI 20 is **not** adequate.

DRAFT

Excelsior indicated that a water balance for the Stage 1 operations was submitted with the Gunnison APP application, and included the JCM process solution ponds.

Excelsior submitted an amendment application for the Johnson Camp Mine (JCM) permit in which they have provided a water balance for the ponds located at the JCM facility.

Regarding managing solutions as a contingency measure during pipeline repairs, Excelsior proposed to installation of a single-lined pond called the Pipeline Drain Pond. Based on the largest anticipated pipe having an outside diameter of 24 inches, the proposed capacity of the pond including design storm volume and two feet freeboard is 1.05 acre-feet. Drawing contained a plan sectional views of the impoundment. However, anchor trench details were missing. Please provide anchor trench details. Also, please clarify what the value of 3.65 used in the calculation of design storm volume represents.

CRAI Comment

21. *A.A.C. R18-9-A202(A)(5)(a) – Process flows were presented in Section 1.2.5 for the three stages of operation. The process flows indicate that mechanical means of evaporation will be utilized to enhance evaporation in the Evaporation Pond. The use of mechanical evaporators is also discussed in Section 5 of Appendix K and Appendix M (for Stage 1). Please provide design of the proposed mechanical evaporation system (for all Stages of the project) and provide a discussion of the potential for overspray beyond the footprint of the pond.*

ADEQ Evaluation

The response to RAI 21 is adequate.

Excelsior provided design documents related to the mechanical evaporation system proposed to be used. Spray drift outside the lined surface of the pond was discussed as a potential; however, Excelsior indicated that during operations, spray drift will be controlled by a weather station and automated controls. "The control system provides for "full automatic operation, weather control panel, weather [monitoring] device with temperature, relative humidity, wind speed and wind direction, and control panel upgrades for automatic control." Operational parameters programmed into the control system will be modified with time and experience to ensure that system operation is modified or shutdown to prevent spray drift from leaving the lined area of the Evaporation Pond."

CRAI Comment

22. *A.A.C. R18-9-A202(A)(2) – In Figure 2-1, is the parcel of land titled "Benson 1550 LLC" property part of the Gunnison Copper Project or excluded from it?*

ADEQ Evaluation

The response to RAI 22 is adequate.

DRAFT

The surface of the parcel in discussion is owned by Benson 1550 LLC. The parcel formerly owned by Johnson family sold the surface to Benson 1550 LLC, but retained the rights to the subsurface.

CRAI Comment

23. *A.A.C. R18-9-A202(A)(5)(a) – Section 3.4, Site Specific Geology, indicates there are 217 drill hole data points in the region, including 122 drill holes immediately in the resource area, and 95 drill holes within the project area. As per Section "3.4.5.3.1 Discharge Control - In-Situ Leaching With Deep Well Injection" of the BADCT manual, "Boreholes or wells, which may act as conduits for leachate to contaminate aquifers, should be plugged and abandoned in accordance with Arizona Department of Water Resources rule R12-15-816 and required UIC regulations (40 CFR Part 146)". Please indicate the schedule and procedure to abandon the drill holes and any other boreholes and wells located within the project area or the immediate vicinity of the ISLR operations.*

    This section also indicates there are several faults within the project area. Please provide an evaluation of the potential for activating a fault based on the proposed in-situ and recovery operations.

    ADEQ Evaluation

    The response to RAI 23 is **not** adequate.

    Excelsior indicated that they plan to retain the NSH monitoring wells to serve as intermediate monitoring wells, and plug and abandon wells/coreholes within the wellfield that will not be used as intermediate observation wells prior to injection operations. Prior to injection operations these borings will be left open since they may be used as observation wells during aquifer testing. Please see ADEQ Evaluation for RAI 16, Alternative 1, subpart c on when a well and/or core hole would be abandoned. The abandonment procedure described in Excelsior's response to RAI 23 is adequate.

    Regarding activation of a fault, Excelsior indicated that the magnitude of fault activation is related to the total volume of fluid injected. For this project, "there will be zero net injection, and in fact, with the hydraulic control pumping, there will be net withdrawal. There is no reason to believe that a net withdrawal of groundwater from the site will activate any faults.

    Furthermore, injection at the site will not cause fracturing or cause existing fractures to propagate. Fracture gradient testing conducted by Excelsior, and documented in Appendix N of the APP application, identified a conservative fracture gradient of 0.75 psi/ft that is proposed as a permit condition."

CRAI Comment

24. *A.A.C. R18-9-A202(A)(4) & (5)(a) – Section 3.7 indicates "no earthquakes with magnitudes greater than 5.0 occurred in southeastern Arizona between at least 1850 and 2000". Information obtained from the Arizona Geological Survey website, indicates the Great*

Sonoran Earthquake of 1887, which was estimated at 7.4 on the Richter scale was centered approximately 40 miles south of Douglas, Arizona. Recently there have been several earthquakes in the southeastern Arizona region, one 10-miles south of Duncan, Arizona in June of 2014 which was 5.3 on the Richter scale.

Please provide an engineering evaluation that demonstrates the integrity of the facility will not be jeopardized in the event of the Design Earthquake (DE) (BADCT Manual Appendix E). The DE should be evaluated considering known active faults (regionally-occurring) within a distance of 200 km (≈ 125 miles). Figure 3-1 in Volume 1, depicts the Gunnison Hills fault approximately one mile east of the proposed wellfield and impoundments.

ADEQ Evaluation
The response to RAI 24 is adequate.

Excelsior provided an evaluation of potential earthquakes and active faults within a distance of 125 miles. Excelsior also evaluated stability analysis for the Gunnison impoundments.

CRAI Comment52

25. *A.A.C. R18-9-A202(A)(4) and (5)(a) – Section 5.4 indicates that the groundwater beneath the project facility is impacted by volatile organic compounds and other petroleum hydrocarbons, and Section 6.2.7 indicates that the total concentration of organic compounds in the process solutions is expected to be approximately 30 to 50 mg/L total petroleum hydrocarbons (TPH). Please provide an evaluation of hydrocarbon impacts on the following:*

    a. *Impoundment HDPE-liners at the Johnson Camp Mine (JCM) during Stage 1, and proposed Gunnison project Stages 2 and 3.*

ADEQ Evaluation
The response to RAI 25a is adequate.

The concentration of TPH in the groundwater will not pose a concern to the liners.

    b. *Equipment failure and maintenance problems for all mechanical equipment that will be associated with the permitted discharging facilities (well field and process/storage impoundments).*

DRAFT

ADEQ Evaluation
The response to RAI 25b is adequate.

There will be no impact on equipment resulting in a failure.

c. *Chemical changes due to interaction between hydrocarbons known to be present at the site and process solutions (pregnant leach solution (PLS), raffinate, make-up water, and etc.).*

ADEQ Evaluation
The response to RAI 25c is adequate.

The SX/EW process entrains and uses organic compounds as normal part of the copper recovery. Excelsior indicated that the SX/EW process will be an effective way of removing petroleum compounds (if any) from the process water before it is re-injected into the aquifer. The quantity of petroleum VOCs in the impacted wells will have negligible impact on a solvent extraction system.

d. *Compatibility with materials and structures associated with the well field operations (well/wellhead construction, pipelines, etc.).*

ADEQ Evaluation
The response to RAI 25d is adequate.

The materials and structures associated with wellfield operations are designed to be compatible with hydrocarbon concentrations of 30 to 50 mg/l. The low concentrations found in the impacted wells will have negligible impact on wellfield materials and structures.

CRAI Comment
26. *A.A.C. R18-9-A202(A)(5)(a) – Please depict the ore body and the injection and recovery zones on figures showing geologic cross-sections such as Figures 3-5, 3-6, and 3-7 in Volume 1.*

ADEQ Evaluation
The response to RAI 26 is adequate.

Revised geologic cross-sections were provided.

CRAI Comment
27. *A.A.C. R18-9-A202(A)(5)(a) – ADEQ understands that the aquifer at the site is unconfined and is located within both the basin fill and the formations targeted for in-situ leaching of oxide ore. Section 7.1.4.1.2 indicates that due to low hydraulic conductivity, the sulfide zone provides a site specific control on vertical migration of injected solutions. Due to the presence of sulfide zone beneath the injection zone (i.e. the oxide zone), the vertical*

migration potential appears to be limited in the downward direction. Please provide a map showing a plan view of the extent of the basin fill aquifer, and provide a discussion on the potential for upward migration into the basin fill portion of the aquifer.

ADEQ Evaluation
The response to RAI 27 is adequate.

Excelsior indicates that the groundwater in bedrock within the wellfield area responds to pumping tests as if it were under confined conditions.

Providing an accurate basin fill aquifer map is not feasible since it is very limited. There is a potential for upward migration of solutions into the saturated basin fill and this varies across the site. The proximity of extraction wells to each injection well will limit the possibility of upward migration and the bedrock ridge would act as a barrier to lateral movement in the event that any solutions reach the basin fill.

"To mitigate the potential for upward migration, injection/recovery wells will be cased a minimum of 20 feet into competent bedrock (more if bedrock is highly fractured) and the annular space will be grouted to at least 100 feet above the bedrock surface (see Figures 7-2 and 7-3 in the APP application). These construction elements are requirements under the UIC permit."

CRAI Comment

28. *A.A.C. R18-9-A202(A)(5)(a) - Section 9.4.1 indicates "The proposed permit condition is that the 30-day rolling average of total volume of injected fluids will not exceed the 30-day rolling average of total volume of recovered fluids (production plus hydraulic control pumping)". Provide the rationale that maintaining a 30-day rolling average of injected vs recovered volumes is an effective means of demonstrating that hydraulic control and the cone of depression is maintained at all times.*

ADEQ Evaluation
The response to RAI 28 is adequate.

Excelsior indicated that "the vast majority of groundwater particle velocities predicted by the model are less than 1 foot per day and average around 0.2 to 0.3 feet per day. This suggests that solutions, on average, would travel less than 30 feet in a 30-day period".

Excelsior concluded indicating "Because of the low velocities noted, the proposed 30-day rolling average will allow for adequate leeway for mining operations while maintaining sufficient control over mining activities."

CRAI Comment

29. *A.A.C. R18-9-A202(A)(5)(a) – Section 7.1.4.2.2 states "An inward hydraulic gradient will be maintained around the active portions of the ISR wellfield, as measured in observation wells*

located near the hydraulic control wells". Also, Section 10.2.2 indicates "Loss of hydraulic control may occur if fluid levels in the observation wells do not show an inward hydraulic gradient towards the wellfield".

Please note that an inward hydraulic gradient towards the recovery wells shall be established and confirmed prior to the injection of acidified process solution into the injection wells and maintained at all times. Please provide a description of the automatic controls and alarms that will be used in the well field to ensure process upsets do not result in the loss of hydraulic control.

ADEQ Evaluation
The response to RAI 29, part 1 is **not** adequate.

Excelsior indicated "The quoted passage should not be construed to suggest that fluid levels in observation wells are in any way the cause of hydraulic control loss. The statement was intended to convey that fluid levels in the observation wells may indicate, but do not necessarily confirm that the hydraulic gradient toward the wellfield has been lost." "As discussed in response to comment 28, depending on the location of active mining, it could take months or years for a particle to exit the wellfield in the event of hydraulic control loss."

Excelsior does not propose to measure this gradient between injection and recovery wells because levels in pumping and injection wells do not accurately reflect levels in the aquifer. Instead, gradients will be measured at observation well pairs associated with the hydraulic control wells. The water level elevations in each pair will be compared to confirm that the inboard water level elevation is an established amount lower than that in the outboard well. Alarm conditions will notify the operators to implement corrective actions if the water level elevation difference approaches an established alarm level. The actual amount will be established in the field during operations, and this can be addressed as a compliance schedule item.

The evaluation of the amount of time that is needed for excursions of PLS to travel from mine well blocks to the hydraulic control wells is presented above in ADEQ Evaluation to RAI 8.a.ii. In addition, as stated above in ADEQ Evaluation to RAI 16, Alternative 1 subpart a, ADEQ requests Excelsior use multiple lines of evidence, i.e., potentiometric contour map, for establishment of capture per A.A.C. R18-9-A202(5)(b).

Please include a description of the mechanical controls and monitoring devices for the well field injection system(s). An explanation of the process, corrective action, and how these devices will regulate injection and recovery fluid flow should also be provided. The controls and monitoring devices should include:

Injection Well System:

a. *Pressure gauge.*

DRAFT

b. *Flow meter at the injection manifold for measuring flow rates in gallons per minute (gpm).*

c. *Totalizing flow meter for measuring cumulative flow (gallons) into the injection manifold.*

d. *Flow switch at each injection well for indicating flow.*

e. *Valve(s) at each injection well for controlling flow.*

Recovery and Hydraulic Control Wells:

a. *Continuous reading flow meter (gpm) at the recovery manifold.*

b. *Totalizing flow meter (gallons) at the recovery manifold.*

c. *Isolation valve(s) at each recovery well.*

d. *Flow switch at each recovery well.*

e. *Pressure transducer within all or selected recovery wells. Transducers were not noted on the well diagrams provided in Section 7.1.4.4 (Volume I) Figures 7-2 through 7-4.*

ADEQ Evaluation

The response to RAI 29, part 2 is **not** adequate.

Excelsior indicated that controls for the injection and recovery wells will be located in the Header House. With the exception of the pressure transducers for each production well, Excelsior will install the above mentioned controlled and monitoring devices. A transducer may be installed at the discretion of the operator in an individual well or group of wells if necessary.

Per A.A.C. R18-9-A205(A) and R18-9-A206(A), Excelsior shall include transducers for all injection, recovery, hydraulic control, intermediate monitoring (NSH wells), and observation wells in order to monitor groundwater elevations to ensure the cone of depression is being maintained at the PMA boundary.

CRAI Comment

30. *A.A.C. R18-9-A202(A)(5)(a) – Figures 7-2, 7-3, and 7-4 in Section 7, show the use of clean fill as backfill for the well annulus through the Basin Fill (upper well portion), along with a statement in Section 7.1.4.4.4 (Volume I) that "The casing annulus of all Class III wells will be grouted to 100 feet above the basin fill/bedrock contact.", etc. Please indicate if the injection wells meet the EPA Class III Underground Injection Control (UIC) requirements*

and if the well annulus is permitted to be filled with materials other than grout. Please explain why the annulus of the recovery wells contain clean fill as opposed to grout. Also, provide rationale for the uncased portion of the borehole where injection and recovery take place.

ADEQ Evaluation
The response to RAI 30 is adequate.

According to Excelsior, the basin fill is not an underground source of drinking water (USDW); therefore, Excelsior did not modify their original proposal to partially grout the annulus of wells within the well field.

CRAI Comment

31. *A.A.C. R18-9-A202(A)(5)(a) - Section 9.5.1 states "The well will be considered to have passed if there is less than a 5% change in pressure during the 30 minute period". Please confirm that it is the 5% decrease in pressure as opposed to change in pressure.*

ADEQ Evaluation
The response to RAI 31 is adequate.

Excelsior clarified that the 5% change is related to decrease in pressure.

CRAI Comment

32. *A.A.C. R18-9-A202(A)(5) - Provide an analysis of the potential for subsidence within the project site for the life of the facility. As discussed in the BADCT Manual Section 3.4.4.3.2, In-Situ leaching may result in subsidence through the dissolution of underlying rock.*

ADEQ Evaluation
The response to RAI 32 is adequate.

Excelsior indicated that subsidence will not occur due to the in-situ mining operations. Excelsior expressed that the dissolution of copper and other minerals will not result in subsidence.

Volume III - Appendix K - Impoundment BADCT

The following deficiencies apply to all Stage II impoundments. These include: Raffinate Pond, PLS Pond, Recycled Water Pond, Evaporation Pond, Solids Impoundment, and Plant Runoff Pond.

CRAI Comment

33. *A.A.C. R18-9-A202(A)(5)(a) - Appendix K, Section 2.2 indicates entrained organic phase in the Raffinate Pond has lighter density and will float in a thin layer on the surface of the pond, having very limited contact with the pond liner. Please explain what quantity of organics are expected to be found in the dissolved phase. Also please explain why floating organics are not expected to cause liner/seam damage for all lined ponds.*

ADEQ Evaluation
The response to RAI 33 is adequate.

DRAFT

Excelsior expressed that the concentrations of TPH in the ponds on the order of 30 to 50 mg/L are expected from the organic liquid (diluent) used in solvent extraction and these concentrations have proven to be compatible to HDPE liners. Excelsior also referenced a chemical resistance chart provided as an attachment in their response to Comment 25.

CRAI Comment

34. *A.A.C. R18-9-A202(A)(5)(a) - Please provide the leakage collection and recovery system (LCRS) sump design, dimensions, and volume for each pond.*

ADEQ Evaluation

The response to RAI 34 is adequate.

Excelsior provided revised drawings and response provided to Comment 38.

CRAI Comment

35. *A.A.C. R18-9-A202(A)(5)(a) - For each impoundment, please provide a topographic map including sufficient detail, showing run-on and run-off storm water drainage for area surrounding each pond using a scale that is large enough to depict contours in the vicinity of the ponds. Please use arrows on the map to show surface water flow direction(s).*

ADEQ Evaluation

The response to RAI 35 is adequate.

Revised drawings with additional information is provided in response to Comment 38.

CRAI Comment

36. *A.A.C. R18-9-A202(A)(5)(a) - Please provide the design for erosion control (rip-rap or diversion ditches, etc.) to protect the elevated portions of perimeter embankments. Please indicate the approximate height of the embankment in relation to the surrounding ground level for the cross-section view of all the ponds presented in Appendix K, Figures K-2 through K-8. In some cross-sections, there appears to be no embankment provided, please explain. Indicate arrows on the drawings to show where the surface flows are anticipated to enter the pond.*

In case of the Plant Runoff Pond, Section 7.5, Volume I, indicates that surface flows will be directed into the western end of the pond. Please indicate if the Plant Runoff Pond is designed to accept surface flow along the entire western edge. Indicate arrows on Drawing No. 350-CI-008 to show where the surface flows are anticipated to enter the pond. Also, Section R of the same drawing shows a relatively small embankment along the western edge. Please indicate the height of the embankment on the drawing.

ADEQ Evaluation

The response to RAI 36 is **not** adequate.

Rip rap along the toe of selected slopes were added to the revised drawings provided in response to Comment 38. Embankments higher than existing ground are not always necessary since pond edges along higher ground with small contributing watersheds have minor run-on potential. Run-on into ponds will be prevented by ditches, swales and berms.

Plant Runoff Pond design was revised (figure K-8 in response to Comment 38) to promote controlled inflow into the pond.

Excelsior included a document titled "Plant Site Drainage Analysis Summary" prepared by M3 Engineering dated August 29, 2016 on a CD. However, this document was not sealed by the engineer. Per A.R.S. § 32-101(B)(11), please re-submit the document prepared by M3 Engineering with the Arizona registered professional engineer's seal.

CRAI Comment

37. *A.A.C. R18-9-A202(A)(5)(a) - For each impoundment, please provide manufacturer's specifications for the liner material, which should also include the acceptable chemical compatibility with the liner system materials and liquids to be contained, including the pH of the extracted fluids from the well field and volatile organic compounds known to be present in the groundwater.*

ADEQ Evaluation

The response to RAI 37 is adequate.

The ponds will be lined with HDPE geomembrane liner. Excelsior indicated that HDPE is compatible with concentrated sulfuric acid, and therefore the relative dilute concentrations of sulfuric acid used in the process solutions (Raffinate Pond) will not pose a concern.
Also, although BTEX is not compatible with HDPE liners, the relatively concentrations of BTEX detected in two wells (CS-10 and CS-14) is not expected to compromise the HDPE liners.

CRAI Comment

38. *A.A.C. R18-9-A202(A)(5)(a) - For each impoundment, please provide a basis and calculations that determined the volumes presented in Tables 2.1, 3.1, 4.1, 5.1, 6.1, and 7.1 in Appendix K of Volume III. Include water balance calculations to account for all inflows and outflows including the 100-year, 24-hour storm. Please explain why the ponds are designed for only 8-hour process volumes and provide a justification. For the Plant Runoff Pond, provide the estimated volume of accidental discharge from other process solution ponds and include this volume in the water balance.*

ADEQ Evaluation

The response to RAI 38 is **not** adequate.

Excelsior had previously included an additional 20% volume to provide operational flexibility. Though the additional 20% volume was considered desirable, it was not

specifically required. In place of the 20% additional volume, Excelsior provided the additional volume required for a 100-year, 24-hour storm event. Excelsior provided revised tables in the revised Appendix K provided in response to this comment.

The Evaporation Pond previously proposed for Stage 2 and 3 has been proposed to be used in Stage 1 and has been renamed as Evaporation Pond #1. In the future, Excelsior may add another evaporation pond (Evaporation Pond #2) under an amendment to the permit.

Revised drawings showing contours, v-ditches, and diversion ditches were provided in the revised Appendix K (these were not presented in the original Appendix K).

A mathematical error was identified for the Solids Impoundment (Table 5.1, page K-21) in which the Total Volume Required (ft^3) was presented as 15,204,180, while the total of the Accumulated 60% Precipitate Slurry Volume (13,872,750), Design Storm Volume (217,800), and Two Feet Freeboard Volume (1,203,630) is 15,294,180 ft^3. Please resubmit the revised calculations, or alternatively acknowledge typographical error.

CRAI Comment

39. *A.A.C. R18-9-A202(A)(5)(a) - Please provide the locations of all borings (abandoned wells, boreholes, etc.) located within the footprint and within 150-feet of the perimeter of each pond. All borings must be properly plugged in order to prevent the potential migration of impoundment fluids due to liner failure.*

ADEQ Evaluation

The response to RAI 39 is **not** adequate.

Excelsior indicated that there are a total of four wells within 150 feet of the perimeter of the PLS Pond. Information related to the four wells was provided. However, the information does not match the ADWR records (well depth, casing depth, and casing diameter). See screenshots below.

Also, Excelsior did not state that they would abandon the wells found within 150 feet of the perimeter of the pond.

Please correct the information for the wells as per ADWR records, and indicate which wells, if any, are planned to be abandoned.

Excelsior Response to Comment 39

ADWR Registry ID	CADASTRAL	Well Name	Owner	Well Type	Depth (ft)	Casing Depth (ft)	Casing Diameter (in)	Lattitude	Longitude
224035	D(15-23) 31CAD	NSH-020	EXCELSIOR MINING CORP	ENV - MONITOR OR PIEZOMETER	1600	1582	4.5	32.08374886	-110.038526
224101	D(15-23) 31CAD		EXCELSIOR MINING CORP	ENV - MONITOR				32.08406809	-110.0387882
224100	D(15-23) 31CAD	NSH-018	EXCELSIOR MINING CORP	ENV - MONITOR OR PIEZOMETER	997	992	4.5	32.08419361	-110.0385209
917777	D(15-23) 31CDA	NSH-029	EXCELSIOR MINING CORP	ENV - MONITOR OR PIEZOMETER	710	709	2.375	32.08296473	-110.0385398

Data from Arizona Department of Water Resources Well Registry Database

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ADWR Website

Reg No.	GWSI Site ID	Cadastral	Owner Name	Well Type	Well Depth (ft)	Casing Depth (ft)	Case Dia (in)
17777		D15023031CDA	EXCELSIOR MINING CORP	MONITOR			
24101		D15023031CAD	EXCELSIOR MINIING CORP	MONITOR			
24035		D15023031CAD	EXCELSIOR MINIING CORP	MONITOR	710	700	7
24100		D15023031CAD	EXCELSIOR MINIING CORP	MONITOR	997	960	4

CRAI Comment

40. A.A.C. R18-9-A202(A)(5)(a) - Please provide a Quality Assurance/Quality Control (QA/QC) Plan including all BADCT elements.

ADEQ Evaluation

The response to RAI 40 is **not** adequate.

Excelsior provided a QA/QC plan prepared by Paul Axelrod. The document was not sealed. This document shall be sealed by an Arizona registered professional engineer.

CRAI Comment

41. A.A.C. R18-9-A202(A)(5)(a) - According to Appendix K, Section 7.7, of Volume III, the Plant Runoff Pond will be used to receive overflow from the Raffinate Pond. BADCT Manual Section 2.2.3 recommends that "if a Non-Storm Water Pond is used for overflow protection, the contingency plan must include procedures to either neutralize leachate/solution prior to discharge or pump-back overflow so residence time in the Non-Storm Water Pond can be limited." ADEQ was unable to locate this specific requirement within the Contingency Plan located in Section 10 of Volume I of the above referenced document. Please clarify.

ADEQ Evaluation

The response to RAI 41 is adequate.

Excelsior's response is below:

> "The Raffinate Pond is sized for operating volume, pump downtime, the design storm, and 2 feet of freeboard, in accordance with prescriptive BADCT requirements for process water ponds. Therefore, the Plant Runoff Pond will not receive overflow from the Raffinate Pond and therefore, no changes will be made to the Contingency Plan."

Based on the Excelsior's response Raffinate Pond is sized adequately and the Plant Runoff Pond will not receive runoff from the Raffinate Pond.

Volume I - Section 7.1.5 Wellfield Closure Strategy [A.A.C. R18-9-A202(A)(10)]:

CRAI Comment

42. This section does not indicate when the Stage 1 wells will be abandoned; i.e. whether they are abandoned as the rinsing for a given 5-spot is completed demonstrating that

concentrations of all constituents are at or below acceptance criteria (as stated in Appendix M), or at the end of Stage 1. Provide a detailed closure strategy including the schedule of abandoning the wells as mining activities progress.

ADEQ Evaluation
The response to RAI 42 is **not** adequate.

Wells will be plugged and abandoned after rinsing of a mine block is complete. There is no plan to wait until the end of Stage 1 to plug and abandon wells.

In general, wells that begin leaching operation a given year will be ready for abandonment in Year 8 (Four years of leaching, early stage rinsing in Year 5, one year rest period in Year 6, late stage rinsing in Year 7, and abandonment in Year 8). In some cases wells located adjacent to a mine block may not be immediately abandoned and instead may be used for observation purposes.

Excelsior must provide an evaluation of the mine plan to ensure no wells are abandoned prematurely. For example, based upon Figure 8-1, mining may be taking place upgradient of year 1 and other earlier years mining. While the year 1 mine location may have been rinsed, relaxed and rinsed again, potential "PLS" may become present again in the year 1 mine location.

CRAI Comment
43. *According to Volume 1, Section 7.1.5.1, page 12, a sample size of "approximately 10% of the wells within the mining block" will be monitored to determine the effectiveness of groundwater rinsing. Please provide the rationale, including references, for selection of this sample size. ADEQ believes that this is too low and that all wells within the PMA should be monitored to determine the effectiveness of rinsing.*

ADEQ Evaluation
The response to RAI 43 is **not** adequate.

Excelsior indicated that during the project life there will be 1,400 injection/recovery wells over 192 acres. The sampling of all wells is not reasonable due to the close spacing of the wells and due to the fact that many of the samples from injection wells would simply reflect collection of recently-injected clean rinse water.

Sampling of 10% wells equate to one well for every 1.4 acres. Excelsior considers this to be a high sample density that will adequately characterize the effectiveness of rinsing.
Please see ADEQ Evaluation for response to RAI 14.b, and RAI 16 Alternative 1, subpart d.

CRAI Comment
44. *Please add to the laboratory analyses list (Section 7.1.5.1, page 12, paragraph 3, Volume I) volatile organic compounds (VOCs), due to site contamination.*

ADEQ Evaluation
The response to RAI 44 is adequate.

Excelsior's response is below:

"In order to address ADEQ's comment, the following statement will be added to the above referenced paragraph:

> In addition, as discussed in Section 9, eight rounds of ambient monitoring for the organic constituents listed on Table 9-1 will be conducted at the POC monitoring wells to establish ALs and AQLs. One compliance sample will be collected from each of the POC wells at the end of the first rinsing cycle to verify that groundwater quality at the POCs meets the AQLs. If any organic constituents exceed a permit AL or AQL, sampling will be repeated after each round of rinsing.

The analysis of organics was already included in the post-closure monitoring costs.

Please note that the site should not be identified as contaminated. As discussed in the APP application submittal, a likely source of organic compounds in several bedrock boreholes is an adjacent site that was previously closed by ADEQ. Any VOCs that are currently present within the boundaries of the Gunnison Copper Project permit area will be removed by the extraction well network during wellfield operations."

Volume III - Appendix M - Wellfield Closure Costs [A.A.C. R18-9-A201(B)(5)]:

CRAI Comment
The closure costs provided in the application lack sufficient details. The closure and post-closure costs should contain information including, but not limited to the following: unit costs (not lump sum), unit rates, materials quantities, labor costs, mobilization/demobilization costs, equipment costs, sampling and analytical costs, etc. Use third party costs for activities to be performed by a 3rd party contractor. Include contingency costs for the overall closure and post-closure costs including justification. The contingency costs should take into account the potential for additional rinsing (if required) beyond the time frame predicted by the geochemical model results presented in Appendix J. ADEQ recommends the use of Nevada's 'Standardized Reclamation Cost Estimator' (SRCE) for determining mine closure costs.

ADEQ Evaluation
The response to Volume III – Appendix M opening comment, is adequate.

Excelsior provided a revised Appendix M containing Stage Closure Costs. An overall contingency of 10% was used, and they indicated that 10% is acceptable "since the costs are based on detailed quantities and accurate unit rates."

"Contingency costs for additional rinsing are already included in the rinsing cost." Geochemical modeling in Appendix J.1 indicated that all regulated constituents will be below AWQS (with the exception of fluoride). Excelsior added two final rinses into the wellfield closure plan as a contingency.

CRAI Comment

45. ADEQ understands that in-situ leaching will occur in the oxide ore body which contacts the basin fill at varying elevations at the project site. The aquifer is within the basin fill where the contact between the basin fill and the oxide is below the water table. There may be a potential upward migration of injected fluids into the basin fill (refer to Comment No. ~~10~~ 27). Please include the closure costs for rinsing in the basin fill portions of aquifer which could contain injected fluids.

ADEQ Evaluation

The response to RAI 45 is **not** adequate.

Excelsior indicated that they do not plan to rinse the basin fill since there will be no injection of solutions into the basin fill. Revised geologic cross-sections were provided in response to comment 26.

A bedrock ridge composed of limestone is present east of the wellfield. If groundwater is present in the basin fill, it will be neutralized as it flows through the limestone.

The revised Stage I Closure Costs were developed for 10 years using third party contractor costs. Closure costs for the Evaporation Pond #1 and Pipeline Drain Pond were also included. Costs included removal of mechanical evaporators, earthwork, dewatering, placement of geotextile for covering evaporation solids, rip-rap to protect surface drainages, and revegetation/reseeding of the pond surface after covering.

The closure costs took into account credits for closure work that would have been completed in a given year starting in Year 5. The maximum liability was identified in Year 8 in the amount of $8.420 million.

Please include revised closure costs based upon comments to ADEQ's evaluation of RAI 8.a.ii.

CRAI Comment

46. Under the header titled "Fixed Closure Costs", the following statement was included:

"The maximum number of wells in operation in any year is 63 recovery wells and 42 injection wells…"

Does the above statement indicate that in the final year of Stage 1, there will be 42 injection

wells and 63 recovery wells that will require closure? See Comment No. 35 below for additional questions regarding the number of wells planned for Stage 1.

ADEQ Evaluation
The response to RAI 46 is **not** adequate.

Excelsior provided a table of injection and recovery wells planned by each year for Stage 1. The table included well installed, closed and in rinse phase and indicated that Year 7 will have the maximum number of production wells comprised of injection and recovery wells.

Please see comments to ADEQ Evaluation of RAI 42.

CRAI Comment
47. Under the header titled "Variable Closure Costs", the following statement was included:

"Some of the wellfield closure costs are dependent on the number of wells that need to be rinsed and closed at any given point in time."

a. Information relating to the number of wells included in evaluating the closure costs for Stage 1 was not evident in the application. Please provide an evaluation of closure costs based on the number of wells (injection, recovery, observation and hydraulic control wells) planned for closure in Stage 1.

ADEQ Evaluation
The response to RAI 47 is **not** adequate.

Excelsior indicated that 200 wells are planned for Stage 1. The number of wells planned for closure in Year 10 is 48. The response states "no observation or hydraulic control wells are planned for closure in Stage 1 as they would be required in Stages 2 and 3; however, costs were included for closure of these wells (see Table M-1 in response to Comment 46).

Please see comments to ADEQ Evaluation of RAI 42.

Another statement under the same header, included:

"Water supply costs are based on the existing wells at the Johnson Camp Mine...".

a. Please provide information relating to the quantity of water available and quality of water proposed to be supplied by the wells at the JCM facility. Please note that if additional treatment would be required prior to use of the JCM water for rinsing, these costs should be detailed in the proposed closure costs.

ADEQ Evaluation
The response to RAI 47a is adequate.

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As presented in response to RAI 5, Excelsior provided the sources of clean water, and in relation to the quantity of water available, Excelsior provided pump capacities for various wells near the JCM site. Excelsior indicated that test results demonstrated that water from these wells meets AWQS and requires no additional treatment for use as rinse water during the post-production period.

b. Please provide the cost (power and any other associated costs) to inject the rinsate.

ADEQ Evaluation
The response to RAI 47b is **not** adequate.

Excelsior provided the following response.

"There is no power cost to inject rinsate. Water to rinse the depleted production comes from the existing water tank at the Johnson Camp Mine. The power cost to get water to the supply water tank is included in the Water Supply Cost line item (Line 25 in Table M-1 of revised Appendix M). Rinse water for the injection wells flows by gravity from the tank at an elevation of approximately 5,200 feet amsl to the well blocks that vary in elevation from approximately 4,850 to 4,800 feet amsl. This provides a head pressure of from 150 to 170 pounds per square inch, more than adequate for rinse injection."

c. Please explain why verification sampling (Table M-7) will be conducted on only 10% of the recovery wells (see Comment No. 30 43).

ADEQ Evaluation
The response to RAI 47c is **not** adequate.

Excelsior provided the same response as that for RAI 43. Please refer to RAI 43, and RAI 16, Alternative 1, subpart d.

d. In Table M-7, please explain what the number "Recovery Wells Installed" represent for each year; i.e. does this mean that in each year up to Year 10, 480 recovery wells will be installed?

ADEQ Evaluation
The response to RAI 47d is **not** adequate.

Excelsior indicated that the information in Table M-7 was intended to represent the number of recovery (or injection) wells installed and put into production in each of the years of Stage 1 operation. By Year 10 there will be 152 injection/recovery wells (taking into account 48 of the 200 wells will be closed by Year 10). Of these 152 wells, 87 wells are expected to be in active production, 54 in active rinsing or resting, and 11 will be dormant, awaiting closure.

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	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Wells added by Year	38	20	20	17	21	16	18	20	14	16
Cumulative Total Wells	38	58	78	95	116	132	150	150	148	152
Wells closed by Year	0	0	0	0	0	0	0	20	16	12
Cumulative Total Closed	0	0	0	0	0	0	0	20	36	48

NOTE: The number of injection and recovery wells planned by each year is different from that proposed in Table M-7 of the original application (see screenshot below).

Table M-7: Verification Sampling of Rinsed Blocks

Rinse Verification Liabilities and Credits	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Recovery Wells Installed	28	41	52	63	48	51	48	48	48	53
Number of samples (10%)	3	5	6	7	5	6	5	5	5	6
Rinse Verification Liability per Year[1]	$4,895	$8,158	$9,789	$11,421	$8,158	$9,789	$8,158	$8,158	$8,158	$9,789
Recovery Wells Closed	-	-	-	-	-	-	-	18	9	10
Number of samples (10%)	-	-	-	-	-	-	-	2	1	1
Rinse Verification Credits per Year[1]	$0	$0	$0	$0	$0	$0	$0	($3,263)	($1,632)	($1,632)
Cumulative Rinse Verification Liability/Credits	$4,895	$13,052	$22,841	$34,262	$42,419	$52,208	$60,366	$65,260	$71,786	$79,944

[1]Note: Sampling and analysis cost per well estimated at $1,631.50

e. In Table M-8, please provide the basis of the footage of the wells drilled in each year; i.e. number of injection wells, recovery wells, their depths, etc.

ADEQ Evaluation
The response to RAI 47e is adequate except for the timing based upon Comment 42.

In response to the above comment, Excelsior provided a table (see below) of injection and recovery wells planned for installation each year until Year 10. Average depth of wells in this Stage is anticipated to be 1,435 feet, so a depth of 1,450 feet was used to calculate well abandonment costs.

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	TOTAL
Injection wells new	14	9	8	7	9	8	8	9	6	8	86
Recovery wells new	24	11	12	10	12	8	10	11	8	8	114
Total new	38	20	20	17	21	16	18	20	14	16	200

f. Please indicate at what stage the hydraulic control wells and the observation wells will be abandoned. If any are abandoned during Stage 1, please provide the number, type of wells, and the associated cost of abandonment.

ADEQ Evaluation
The response to RAI 47f is adequate.

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As indicated in response to Comment 47.a, there are no plans to abandon hydraulic control and observation wells at the end of Stage 1; however, costs to abandon have been included in Table M-1 (see response to Comment 45).

g. *Please include costs to pump all the hydraulic control wells necessary to maintain hydraulic control until final closure.*

ADEQ Evaluation
The response to RAI 47g is **not** adequate.

The closure costs account for Hydraulic Control Pumping for the year in question, plus three more years for rinsing.

CRAI Comment

48. *Please provide costs associated with wellfield and well abandonment including but not limited to the following:*

- *ADWR fees*
- *Removal of electrical, wellhead assemblies, and control boxes*
- *Well pump removal*
- *Concrete structure removal (pads, monuments, etc.)*
- *Equipment costs*
- *Waste material disposal*
- *Mobilization/Demobilization*
- *Site reclamation (restoration)*

ADEQ Evaluation
The response to RAI 48 is adequate.

Cost proposals were obtained from three licensed Arizona well drillers to derive closure costs to abandon wells. The revised Appendix M, provided in response to Comment 45 contains the above requested information. Abandonment costs were included for injection/recovery wells, observation wells, hydraulic control wells, POC wells, and the existing NSH wells.

CRAI Comment

49. *Please provide detailed breakdown and explanation of how the credits are calculated and applied in the various cost estimation tables (M-7, M-8, and M-9) provided in the application.*

ADEQ Evaluation
The response to RAI 49 is adequate.

A detailed breakdown of costs including credits is provided in response to Comment 45.

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CRAI Comment

50. *No post-closure costs have been provided. Please provide post-closure costs for monitoring and maintenance following the rinse period and the rationale for the duration of post-closure. Please provide a table which clearly shows the closure and post-closure costs by line items.*

ADEQ Evaluation

The response to RAI 50 is **not** adequate. Please see ADEQ's responses to RAI 8.b.

Excelsior provided the following response.

"Excelsior has proposed that rinsing verification monitoring be conducted at 10% of the wellfield injection/recovery wells after the late rinsing stage (see responses to comment 43 and 47c). After numerical AWQSs are achieved, the injection/recovery wells will be abandoned."

Excelsior proposed a longer post-closure monitoring period of 5 years as opposed to the originally proposed four quarters, and provided costs for 5 annual rounds of sampling. Excelsior indicated that this was appropriate "based on the low hydraulic gradients and slow travel times observed in the project area."

Volume III - Appendix O – Alert Level Calculations for LCRS

CRAI Comment

51. *A.A.C. R18-9-A202(A)(5)(a) - The application only includes Alert Level 1 volume for the LCRS system. Please provide calculations for the Alert Level 1 (AL1) and Alert Level 2 (AL2) for all the double-lined ponds. Also, Section 3.2 Results has two tables containing "Depth" and "Max Depth". Please explain what these depths represent. The "Max Depth" used in the calculations to determine the "Proposed AL" does not appear to match the depth presented in the drawings in Appendix K. For example, the drawing for the Raffinate Pond indicates the maximum depth at the shallow end is approximately 19 feet and the maximum depth at the deep end is 23 feet. Please explain why 7 feet used in calculating the AL.*

ADEQ Evaluation

The response to RAI 51 is adequate.

Excelsior provided a revised Appendix O. Excelsior indicated that the pond floors are designed to slope. For the purpose of calculation, they chose to use the maximum depth determined at the lowest pond elevation as opposed to the average liquid depth.

CRAI Comment

52. *Presence of hydrocarbons in the groundwater has been documented in the application. Arizona Revised Statutes (A.R.S.) 49-243(B)(3) states that "no pollutants discharged will*

further degrade at the applicable point of compliance the quality of any aquifer that at time of issuance of the permit violates the aquifer quality standard for that pollutant." Please provide an evaluation that capture and reinjection of hydrocarbon pollutants through the In-Situ process in other parts of the aquifer does not violate requirements of other programs such as the leaking underground storage tank (LUST) program or other applicable ADEQ programs.

ADEQ Evaluation
The response to RAI 52 is adequate.

As discussed in other responses (see response to Comment 3c), the occurrence of hydrocarbon pollutants appears to be limited. These pollutants are expected to be captured through the in-situ process. "Although the SX-EW process is not intended as a remediation measure, it would serve as an effective way of removing any petroleum compounds from raffinate before it is re-injected into the aquifer."

CRAI Comment
53. *Submit revised closure and post-closure cost estimates which comply with the requirements of A.A.C. R18-9-A201(B)(5), based on the respective comments presented in the hydrology and engineering sections above.*

ADEQ Evaluation
The response to RAI 53 is **not** adequate.

Excelsior indicated "Revised closure costs will be submitted by Excelsior, after review and approval by ADEQ and EPA of responses to comments 45 through 50." Based on ADEQ comments to RAI 45 through 50, submittal of revised closure and post-closure costs may be required. Additionally, please note that ADEQ will require the revised closure/post-closure costs to be submitted irrespective of EPA's approval.

CRAI Comment
54. *Submit a financial demonstration, including a financial assurance mechanism for the revised closure and post-closure costs for Phase I which comply with the requirements of A.A.C. R18-9-A203(B) based upon the ADEQ-approved closure and post-closure cost estimates. Until such time, this item will remain a deficiency.*

ADEQ Evaluation
The response to RAI 54 is adequate

Following approval of the closure costs, Excelsior will provide the financial demonstration and financial assurance mechanisms.

New Comment No. 55
55. ADEQ identified errors in the cost estimation spreadsheets pertaining to the closure and post-

closure costs. ADEQ provided screenshots with comments to Mr. Paul Axelrod of Axelrod, Inc. and these comments were discussed on January 13, 2017 (see attachment). Based on the comment in the screenshots and discussions with Mr. Axelrod, please provide revised cost estimation spreadsheets.

Additionally, ADEQ identified the following errors pertaining to the revised Appendix M:

a. In the text preceding Table M-4, there appears to be a typographical error in the cost per gallon which is presented as $0.0003442/gallon or $298.28/Mgal. Please acknowledge the error or provide a revised page.

b. Table M-11 has cost in linear feet for cutting and folding liner. Please explain how the cost to fold a liner is estimated based on liner feet vs. square footage.